TECHNICAL SERVICE MANUAL

ELECTROCARDIOGRAPH MODEL

Cardioline® AR 1200 VIEW

P/N: 80509531
80509532

CE 0470

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1 Introduction

ar1200 view combines reliability, modularity, versatility and capacity to be updated which characterise the latest generation of **cardioline**® electrocardiographs.

ar1200 view is a portable electrocardiograph with dual power supply, (mains and rechargeable internal batteries), which in the basic configuration will:

- ✓ record an ECG exam in automatic or manual mode;
- ✓ reproduce the ECG signal on 120 mm paper in 3-6 channel format thanks to the high resolution thermal printer;
- ✓ storage of the most recent recording in automatic mode and print additional copies.

*In just a few minutes, your **ar1200 view** can be equipped with:

- ✓ “memory option”: to store up to 40 full ECG exams, with no need to print out immediately on paper (“paper saving” mode);
- ✓ "ECG measurements option": automatic ECG parameter measurement program;
- ✓ "ECG signal interpretive option": a useful and dependable diagnostics support provided by the “HES” program;
- ✓ "arrhythmia option": program enabling detection of arrhythmia events during continuous recording;
- ✓ “HRV analysis option”: program enabling detection of variations in heart rate;
- ✓ "L.E.M.S - PC archive option": to store the exam to archive on a Personal Computer running “L.E.M.S.” (Local ECG Management System) software;
- ✓ "R.T.E. - PC-ECG option": for real time display of the twelve leads on your computer screen to allow management of patient medical records and archiving of exams in digital format using " R.T.E" (Real Time ECG) software. R.T.E has an optional "HES" module for automatic interpretation of the ECG signal.

* By updating the firmware. Contact your distributor for further details.

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1.1 Particular recommendations and warnings

- ✓ This service manual is for the use of competent technical staff only.
- ✓ Always use the equipment according to the instructions in this manual.
- ✓ The device is equipped with a set of standard accessories. For reasons of safety, reliability and conformity with the Medical Devices Directive 93/42/EEC, use only original accessories or accessories approved by the manufacturer.
- ✓ The device is equipped with a special long-life thermal head writing system, which allows maximum writing precision. To avoid frequent and costly replacements and repairs, always use the original paper or paper approved by the manufacturer. The manufacturer will not accept liability for any damage to the device or any other adverse effect caused by the use of unsuitable paper.
- ✓ Do not subject the device to impact or excessive vibrations.
- ✓ Do not allow liquids to penetrate inside the device. If this should accidentally occur, have the device tested by an Authorized Assistance Centre to verify its functional efficiency, before using it again.
- ✓ Make sure that the value of the supply voltage corresponds to that indicated on the data plate of the device.
- ✓ If you are using the device in connection with others, ensure that: all connections are made by skilled persons; all connections comply with safety regulations; all other devices connected respond likewise to regulations. Non-compliance with these regulations can cause physical harm to the patient connected and to the person operating the device. Should it be difficult to obtain the necessary information for assessing the risk of the individual connections, apply directly to the manufacturers concerned or avoid making the connections.
- ✓ In the event of other equipment being connected directly or indirectly to the patient, check for the possible risks caused by the sum of the leakage currents on the body of the patient.
- ✓ The device is protected against defibrillation discharges in accordance with IEC standard 601-1-25; to ensure that the signal is restored, use only original electrodes or electrodes responding to IEC and AAMI standards.
- ✓ If an electrosurgical scalpel is in use, the patient cable should be disconnected from the device.
- ✓ In any event, the greatest care should be taken when using defibrillators or high-frequency surgical devices at the same time as the ECG. If you have any doubts while using such devices, disconnect the patient from the electrocardiograph temporarily.
- ✓ The device recognizes the impulses generated by a pacemaker and does not interfere with its operation, as prescribed by standards in use at the time of drafting this manual.
- ✓ Avoid exposing the equipment to extreme temperatures, excessive dust or dirt, and very salty or damp environments; observe the ambient conditions described in detail under the "Technical specifications" heading.
- ✓ Periodically check the efficiency of all accessories and of the device itself. Use the built in test function to perform an initial efficiency check. Contact the Authorized Assistance Centre whenever the device seems to be operating irregularly.
- ✓ To prolong the life of your ar1200view, have it periodically checked at an Authorised Assistance Centre
- ✓ Warning: do not use the device in the presence of anaesthetics or volatile gases!
- ✓ Warning: the indications obtained using automatic interpreting programs or other diagnostic aids must be reviewed and countersigned by a qualified medical person!
- ✓ Warning: the device is provided with an IR interface for the transfer of data to other devices. The IR interface must not be masked , even accidentally, as this will adversely affect its capability and its operation, interrupting and preventing the correct flow of data.
- ✓ Warning: Environmental protection: When no longer in use the device must be disposed of according to local regulation, do not dispose as ordinary refuse.
- ✓ The manufacturer will acknowledge liability for the safety, reliability and functional efficiency of the device only if:
  - modifications and repairs are performed by the manufacturer or by an Authorized Assistance Centre;
  - the a.c. mains power supply of the premises in which the device is used corresponds to current regulations;
  - the device is operated according to user instructions;
  - any accessories in use are those approved by the manufacturer.

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2 Description of the device

The device consists of the following basic elements:

2.1 Mother board

This is a “Fine line” multilayer printed circuit board for mounting SMD components.

It houses most of the electronic circuits of the device.

2.2 Battery

Battery Pack made of 10 cells NiMH 12V.

2.3 Display

Display assembly is composed of: frame, monochromatic LCD display 320 x 240 pixel (4,7 inch) as well as a step up converter.

2.4 Keyboard

The keyboard card consists of the device functional keys and LED messaging devices.

2.5 Printer unit

This consists of the thermal printer head support and the mechanical elements required to position it correctly.

2.6 IR Module (RS232)

The function of the IR module is to transmit and receive data from an external PC.

2.7 Motor assembly

The DC motor with gears for paper speed. Also included strobo disk for speed feedback.

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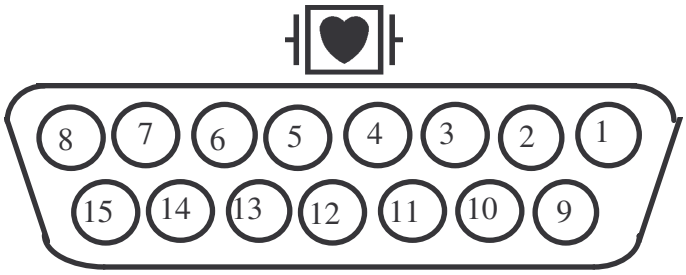
3 Inputs and outputs

Direct connections from the **ar2100 view** to external equipment may only be made using the IR serial port, not by cable.

3.1 Connection to the patient input port



Port from connection side

Pin 1 =	IN	C2	(electrode C2)
Pin 2 =	IN	C3	(electrode C3)
Pin 3 =	IN	C4	(electrode C4)
Pin 4 =	IN	C5	(electrode C5)
Pin 5 =	IN	C6	(electrode C6)
Pin 6 =	AGND		(analogue ground)
Pin 7 =	NC		
Pin 8 =	DGND		(digital ground)
Pin 9 =	IN	R	(electrode R)
Pin 10 =	IN	L	(electrode L)
Pin 11 =	IN	F	(electrode F)
Pin 12 =	IN	C1	(electrode C1)
Pin 13 =	NC		(non connected)
Pin 14 =	IN	N	(electrode N)
Pin 15 =	NC		(non connected)

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4 Testing the safety characteristics

The safety regulations envisage two important tests:

- ✓ The leakage currents test measures the value of the currents lost in relation to the safety of the patient and the operator.

Warning: All safety tests must be performed according to standards EN.60601-1(1990 paragraphs 19 - 20) EN 60601-2-25 (1995) unless otherwise specified in the local safety regulations.

4.1 Leakage currents test

Warning: This test must be performed every time the device has been opened for inspection and/or repair, and in any event every two years, unless otherwise specified by the local safety regulations.

Connect the electrocardiogram to the battery charger, and then connect this assembly to the measuring instrument according to the instrument's manual, recalling that:

1) The leakage current to the casing is measuring between the mains supply circuits and a metal sheet no greater than 20 x 10 cm pressed against the casing of the device.

2) The leakage current in the patient is measured between the mains and the applied part. For connection to the applied part use the patient lead itself.

3) The leakage current in the patient with mains voltage directly on the applied part (first failure condition) is measured between the meta sheet connected to the device and the applied part.

4) The auxiliary current in the patient is measured singly on each electrode (excluding the reference electrode) compared to all the other electrodes connected together.

Note: Make the measurements following the indications in the instrument user manual, and check that the leakage current values measured are less than or equal to those listed in table IV.

Table IV.

Admissible permanent values for leakage and auxiliary currents in the patient in mA (milliamperes).

Current path	CF type	
	N.C.	S.F.C.
Leakage current to earth	0.5	1
Leakage current in case	0.1	0.5
Leakage current in the patient d.c – a.c.	0.01	0.05
Leakage current in the patient (mains voltage in applied part)	-----	0.05
Auxiliary current in patient d.c – a.c.	0.01	0.05
N.C. = Normal condition S.F.C. = First failure condition		

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5 Testing the main technical characteristics of the ecg

Warning: All tests must be performed in compliance with the provisions of the related general, detailed and performance safety regulations listed in the technical characteristics section

5.1 Instruments necessary:

a) sample mV generator with the following characteristics:
b) low frequency sine wave generator;
c) ECG simulator.

5.2 Sensitivity test

- ✓ set the device up to record 6 channels on leads V1 to V6 with sensitivity of 20 mm/mV;
- ✓ connect the patient cable to the device;
- ✓ connect terminals C1 ÷ C6 of the patient cable connected to the device to the positive pin of instrument 5.1.a);connect all the other cable terminals to the negative pin of instrument 5.1 a);
- ✓ record the signal for a few seconds;
- ✓ check that the amplitude of the recorded signal is 20mm. +/- 5% on all channels.

5.3 Testing the ECG leads

- ✓ switch the device on;
- ✓ connect the patient cable to the device;
- ✓ connect the red termination of the patient cable to the positive pin of the instrument specified in point 5.a.a and the remaining wires to the negative pin.
- ✓ start recording and check that the amplitude in mm of the signal, and its polarity (positive or negative) comply with the values indicated in table 5.3.
- ✓ repeat the measurements in sequence with the remaining active terminations G - V - C1 - C2 - C3 - C4 - C5 - C6 of the patient cable using the method described in c), and check that the values correspond to those indicated in table 5.3.

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PATIENT CABLE AND LEADS TEST	
CONNECTIONS FOR THE TEST	
INSTRUMENT	**PATIENT CABLE CONNECTIONS**
Connector: Patient cable terminations	N. 1 Termination to positive apart from black
+ ◎ : ①	N. 4 Terminations to negative with 5 wire cable
- ◎ : ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩	N. 9 Terminations to negative with 10 wire cable
Square wave signal from: 1 Hz ± 1% 1 mVpp ± 3%	Electrocardiograph: amplification 1mV/10mm signal recorded in mm ±5%

TABLE OF VALUES

Term. to positive	LEADS AND VALUE OF IMPULSE											
	I°	II°	III°	aVR	aVL	aVF	V1	V2	V3	V4	V5	V6
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
R	- 10	- 10	0	+ 10	- 5	- 5	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3
G	+ 10	0	- 10	- 5	+ 10	- 5	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3
V	0	+ 10	+ 10	- 5	- 5	+ 10	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3	- 3.3
C1	0	0	0	0	0	0	+ 10	0	0	0	0	0
C2	0	0	0	0	0	0	0	+ 10	0	0	0	0
C3	0	0	0	0	0	0	0	0	+ 10	0	0	0
C4	0	0	0	0	0	0	0	0	0	+ 10	0	0
C5	0	0	0	0	0	0	0	0	0	0	+ 10	0
C6	0	0	0	0	0	0	0	0	0	0	0	+ 10

Table 5.3

5.4 Testing the paper feed rate

- ✓ switch on the device and connect the patient cable;
- ✓ connect terminals C1 ⇂ C6 of the patient cable to the positive pin of instrument 5.1.a);
- ✓ connect all the other cable terminals to the negative pin of instrument 5.1 a);
- ✓ using the instrument with a square wave of 1 Hz and an amplitude of 1 mVpp;
- ✓ record the signal on leads V1 ⇂ V6;
- ✓ measure the length of the wave cycle recorded on the paper.

The results should be as follows:

Period = 50 mm +/- 5% for a feed rate of 50 mm/s;

Period = 25 mm +/- 5% for a feed rate of 25 mm/s;

Period = 5 mm +/-10% for a feed rate of 5 mm/s;

5.5 Frequency response test

- ✓ switch on the device and connect the patient cable;
- ✓ connect terminals C1 ⇂ C6 of the patient cable to the positive pin of instrument 5.1.a);
- ✓ connect all the other cable terminals to the negative pin of instrument 5.1 a);
- ✓ set the sine wave generator to 10Hz with an amplitude of c. 1mVpp;
- ✓ select leads V1 ⇂ V6 and a sensitivity of 10 mm/mV.;
- ✓ make a recording and adjust the amplitude of the generator so as to obtain a 10 mm excursion of the signal recorded;
- ✓ vary the generator frequency from 0.5Hz to 100Hz with constant amplitude;
- ✓ check that the frequency response is in accordance with the values in table 5.5.

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Amplitude of signal in mVpv	Unfiltered sinusoidal input signal in Hz	Relative tolerance of signal 10 Hz – 10 mm
1	From 0.67 to 40	± 10%
1	From 40 to 100	+ 10% - 30%
0,5	From 100 to 150	+ 10% - 30%

Table 5.5

Note: ***The 0.5 Hz pitch linear phase anti-drift filter is always on and cannot be switched off.***

The 50 or 60 Hz filter eliminates modified notch digital type mains disturbances in the linear phase, with a frequency response of 32 Hz - 3dB.

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6 Functional blocks

6.1 Mother board

The motherboard is based on the following principal components:

6.1.1 Processor

- ✓ 32 bit Fujitsu MB91101 RISC microprocessor with 12 MHz clock
- ✓ 2 x 4 Mb static rams
- ✓ 2 x 8 Mb flash memories including the following software:
  - boot code;
  - operating system software;
  - applications software;
  - calibration data;
  - ECG archive.
- ✓ Execution of static ram self test.

6.1.2 Connection to mains

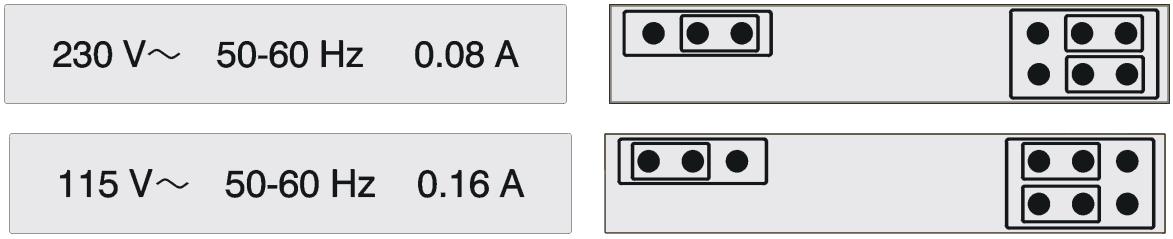
The equipment must be connected to a mains voltage 115 V~ or 230 V~ ± 10%, 50- 60 Hz .

The mains voltage switch is located under the label (see table T1, rif. 5-6).

Changing mains voltage imply the replacement of the mentioned label. ***Only original ones can be used to assure proper electrical isolation.***

In order to change mains voltage move the 3 jumper as illustrated in the picture below.

Changing mains voltage does not require mains fuses rate modification.



Bottom view

Warning: Changing mains voltage imply the replacement of the mentioned label. Only original ones can be used to assure proper electrical isolation.

In order to change mains voltage move the 3 jumper as illustrated in the picture below.

The Manufacturer declines all responsibility for any damage caused as a result of tampering.

6.1.3 Battery charger

The battery charger section consists of the following parts:

- ✓ Adapter circuit, 230/115Vac, switched trough jumper on the equipment bottom, out 22 Vac, fuse protected, and PTC protection against overheating.
- ✓ Mains filter against electromagnetic disturbances.
- ✓ Rectification, voltage stabilisation and current limitation circuits.

Testing the battery charger circuit (see sheet 2 el diag)

- ✓ If the mains on led does not light up, check using the following procedure:
- ✓ Disconnect the mains cable;
- ✓ Check the externally accessible mains fuses;
- ✓ Disconnect the battery from the device as indicated in chapter 8.4;

- ✓ Connect a amperometer to the free terminal caps;
- ✓ Connect the mains cable: the reading should indicate a current of 150 mA ± 15;
- ✓ If the reading is outside the range of values indicated, replace the motherboard.

6.1.4 Internal circuit power supply

This consists of the following power supplies:

- ✓ +5 V generated by a switching type voltage regulator;
- ✓ 5 VI – VL to supply the patient input analogue circuits on the hybrid circuit (insulated part);
- ✓ + 3.3 V generated by a linear regulator to supply the control logic;
- ✓ + 3 V reference voltage for the A/D converter;
- ✓ VTPH voltage obtained from the battery to supply the thermal head. This voltage is limited to a current of 5A and stabilised in voltage at +25 Vdc enabled only when printing.

Testing internal circuit power supplies (ref sheet 2 el diag)

- ✓ Check fuse F1 (T 5A);
- ✓ If no power is supplied to the internal circuits, replace the motherboard.

6.1.5 ECG acquisition

This consists of the following parts:

- ✓ Patient input connector;
- ✓ Protection against defibrillator discharges;
- ✓ Signal polarisation circuit;
- ✓ Hybrid circuit for amplification, filter and clamp.

6.1.6 Motor control

This consists of the following parts:

- ✓ Stroboscopic sensor control;
- ✓ Phase comparator between reference frequency and motor feedback;
- ✓ Current amplifier for motor power supply.

6.1.7 Display control

This consists of the following parts:

- ✓ Display controller S1D13704 EPSON;
- ✓ Buffer adapter level from 3,3V to 5V;
- ✓ Step up converter for LCD power supply.

6.2 Display assembly

This consists of the following parts:

- ✓ Graphic LCD monochromatic 320 x 240 pixel (4,7 inch), effective area 100x75 mm;
- ✓ Step up converter for back lit lamp power supply

Testing the display

- ✓ Execution of display self-test;

6.3 Battery

NiMH battery 12V-1800 mAh

- ✓ The battery is protected against short circuits by a Polyswitch 3,5A.
- ✓ Complete recharging requires at least 18 hours or longer. The battery can be partially recharged, in this case to prolong the life of the battery it should be fully discharged and recharged every 2 months.
- ✓ Replace the battery with one of equivalent type, voltage and capacity.

Attention: In order to ensure a correct equipment operation and safety, replace the battery with original et medical devices battery pack.

Warning: The battery must only be removed if the device is off and the mains supply cable disconnected.

Do not dispose of a spent battery as ordinary refuse or litter.

Note: The operation of the device is not guaranteed if the battery is flat or missing.

Note: The configuration parameters and any stored ECGs are not lost when the battery is changed.

Note: Update the system date and time after replacing the battery.

Battery check

Proceed as follows to check the efficiency of the battery:

- ✓ Leave the battery on charge for at least 18 hours;
- ✓ Disconnect the mains cable;
- ✓ Activate printing of an ECG in manual mode on 3 channels at 5 mm/s: if the device shows the battery is flat within the first 5 minutes the battery should be replaced.

6.4 Keyboard card

The keyboard consists of:

- ✓ 18 function keys;
- ✓ 10 alphanumeric keys;
- ✓ 1 LED for mains line indication;
- ✓ CPU connection through bi-directional synchronous serial port.

Testing the keyboard card circuits

- ✓ Execution of keyboard self-test;

6.5 Printer unit

This consists of the thermal printer head support and the mechanical elements required to position it correctly.

- ✓ 864 dot high resolution printer head, 8 dots per mm;
- ✓ support;
- ✓ paper feed unit consisting of 1 direct current reduction gears, equipped with stroboscopic speed control;
- ✓ mark detection sensor.

Testing the print unit

- ✓ Execution of printer self-test.

6.6 IR Module

- ✓ The function of the IR module is to transmit and receive data from an external PC. The IR module can be used to perform the following functions:
- ✓ Updating firmware (Loader)*;
- ✓ Batch ECG transmission (L.E.M.S.)*;
- ✓ Real time ECG transmission (R.T.E ir)*.

*Consult the specific manual for further information.

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7 Trouble Shooting

Defect	Possible cause/symptom	Remedy
The device does not switch on in any mode.	Mother board/keyboard card.	Holding down the ON/OFF key, measure 12Vdc on J52 (keyboard connector) pin 3; if absent replace the keyboard card, if not, replace the motherboard.
The device does not switch on when in mains mode.	Mains LED indicator off.	Check mains fuses, if OK replace motherboard.
The device does not switch on when in battery mode.		Check T5A fuse on motherboard. Check efficiency of battery and replace if necessary.
The battery does not charge.	The device has not been charged for long enough. Mains LED indicator off. Defective battery.	Leave the device charging for at least 24 hours. Check mains fuses, if OK replace motherboard. Check efficiency of battery and replace if necessary. Check T5A fuse on motherboard.
Keyboard keys not working..	The key pressed not enabled for the specific function.	Execute keyboard self test and if it fails replace keyboard card.
The paper feeds through without printing.	Paper not suitable, without black page recognition mark.	Check that original paper is being used. Check the paper has been inserted correctly. Check that the 26 Vdc VTPH power supply to the thermal print head is present when printing is active, if not, replace the mother board. Check signals on test point table T8 are present. If good, replace thermal head unit, otherwise replace motherboard.
Anomalous printout.		Clean thermal head. Execute printer self-test, replace thermal head unit if some dots are missing.
Does not print automatically or does not paginate the trace correctly.	Paper not suitable, without black page recognition mark.	Clean mark sensor Perform mark sensor calibration.

Defect	Possible cause/symptom	Remedy
		Replace print unit.
Paper feed defective, or paper finished message with paper present.		Check paper guides are not damaged. Clean rubber roller Replace print unit.
EC signal disturbed or anomalous.	Error message on display, on printout.	See user manual.
The device stops during use.	No functions operational, no commands accepted.	Press reset button on right side of device.
Blank display.	Backlit lamp blown or step up converter failed	Check for brightness regulation Replace display assembly
No data on display.		Check for contrast regulation Perform display self test Verify proper flat connection between mother board and display assembly Verify on display connector J49 presence of LCD data signal (level from 0 trough 5 V), if present replace display assembly otherwise replace mother board

8 How to dismantle and reassemble the device

8.1 General precautions

Disconnect the mains cable before opening the unit.

See chapter 15 (procedures for handling ESD components).

To reassemble the device, perform the operations described below in reverse order, ensuring that all subassemblies and connections are performed correctly.

8.2 Opening and closing the device (table T1)

- ✓ Remove battery pack as per § 8.4;
- ✓ Remove the 6 fixing screws from the mobile base (T1 Ref. 1);
- ✓ Lift the mobile base of the device;
- ✓ Remove the lower mobile part;

To reassemble the equipment proceed in reverse order.

8.3 Removing the mother board (table T2b)

- ✓ Proceed following the instructions in chapter 8.2;
- ✓ Remove 2 screws (T2b Ref. 1);
- ✓ Lift the patient connector side of the board and disconnect the following:

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- keyboard flat;
- thermal head flat;
- motor flat;
- mark sensor card flat;
- display connector flat;
- inverter flat.

To reassemble the motherboard proceed in reverse order.

Warning: Replacing the motherboard means that the paper feed speed and mark presence sensor must be recalibrated.

8.4 Removing the battery (table T1)

Proceed as follows:

- ✓ lay the equipment on a soft work surface with the bottom of the casing facing upwards;
- ✓ remove the door of the battery compartment after having slackened its retaining screw (table T1 Ref. 2);
- ✓ disconnect and remove the set of batteries (table T1 ref.8,9);

To reassembly, proceed in inverse order.

Warning: Respect the correct polarity of the battery connection as specified in Table T1 ref.7,8.

8.5 Removing the keyboard card (table T2b)

- ✓ Proceed as described in chapter 8.3;
- ✓ Remove 5 screws (T2b Ref. 5); replace the keyboard card.

To reassembly, proceed in inverse order.

8.6 Removing the display (table T2b)

- ✓ Proceed following the instructions in chapter 8.2;
- ✓ Remove the 5 screws attaching the display to the housing (T2b Ref. 2);
- ✓ Remove display.

8.7 Removing the motor assembly (table T2b)

- ✓ Proceed as described in chapter 8.3.;
- ✓ Remove 2 screws (T2b Ref. 4) and remove the motor assembly;

To reassembly, proceed in inverse order.

8.8 Removing the printer assembly (table T2b)

Proceed as follows:

- ✓ proceed as in chapter 8.3 for opening the equipment and removing the mother board from the equipment;
- ✓ remove the 2 retaining screws of the printer assembly, see table T2b Ref.3, remove it from its seat, taking care not to damage the dots of the thermal head with hard objects;
- ✓ proceed in inverse order to fit the printer assembly, paying particular attention to the positioning of the mechanical part with screws, washers, etc.; if the printer assembly is equipped with thermal print head regulation see table T4.
- ✓ to obtain long life of the thermal head, using exclusively the heat-sensitive paper recommended by the manufacturer, DOT-CARD® in rolls and packs with height 120 mm is advised. The order code is marked on the bottom edge of the paper;
- ✓ the thermal head is extremely sensitive to electrostatic potentials, it is recommended always to follow the work procedures described in appendix A.

8.9 Removing mark sensor board (table T2a)

Proceed as follows:

- ✓ proceed as in chapter 8.3 for opening the equipment and removing the mother board;
- ✓ to remove the sensor board, force it upwards using a suitable tool. It is glued into its compartment inside the upper casing, see table T2a Ref. 2;
- ✓ to replace the board it is necessary to clean the area in which it is fitted, position it correctly in its compartment, with the output of the flat towards the paper compartment and stick it down with instant glue;

- ✓ to close the equipment perform the operations in inverse order;
- ✓ the replacement of the sensor card requires its calibration, see chapter 8.

8.10 Dismantling the paper feed (table T1)

The paper compartment door system is a mechanical device, inserted in the casing, accessible from the outside, driven by the motor of the equipment, which transports the heat-sensitive paper.

It is located above the paper compartment and covers it completely.

To remove this part, proceed as follows:

- ✓ Insert a tool in the special hollow in the left-hand wall of the equipment where the paper comes out and exert pressure upwards so as to release the paper compartment door.
- ✓ This assembly must be disassembled before inserting a roll or pack of paper, when cleaning the roller and always before opening the equipment.
- ✓ To reassembly it, slip it into place with the rubber roller towards the inside of the equipment and holding it up on the other side. As soon as it is inserted, press gently down, on the raised side, so as to snap it shut.

Note: If the roller is not clean and the paper compartment door is badly inserted or fastened, the paper transport is faulty and the equipment functions incorrectly.

8.11 Dismantling and replacing the keyboard membrane (table T1)

The keyboard plate is an elastic membrane fitted on top of the keyboard to allow its control buttons to be pressed.

This self-adhesive plate is stuck onto the top of the equipment.

To replace it when worn, lift one corner using a fine blade and pull it off the casing.

If any adhesive is left on the casing, you must remove it by rubbing with your fingertips.

To fit a new plate, center it with the corners in the space provided and press gently over the whole surface.

Note: A broken or cracked keyboard membrane compromises the safety of the device.

9 Calibration and setting

9.1 General information

This device has a system to automatically set the paper feed speed and mark detection sensor.

The device does not require further setting.

The calibration system may be accessed from the service menu as described below.

9.1.1 Self-test

The device is pre-set to execute self-testing of the main functions: the access sequences for the various menus are guided on the display.

Two types of self-testing may be performed: USER (1) and SERVICE (2), according to the tests to be executed.

USER

To enter the self-testing menu, switch on the device, press the MENU key and select and confirm the TOOLS, SELF-TEST, USER(1) submenu using the arrow key (DOWN). The following tests are available in the operator section:

Display: pixel scan. The presence of blank areas signifies faulty operation of the display.

Keyboard: the position of the single keys is simulated in the display. Pressing a given key, the corresponding area of the display is highlighted in reverse. A lack of response in any one area indicates that the relative key is faulty.

Printer: the system prints two triangular waves, the character set in the memory, and signals with different speeds and sensitivities. Irregularities in the printing system are indicated by the presence of non-continuous lines (burnt dots).

Memory: a non-destructive test is performed on the memories (the data in the memory are not cancelled), and a report of the following type is then printed (all tests OK).

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<<< ar1200 view MEMORY TEST >>>

Boot : CRC OK

Application : CRC OK

Language : CRC OK

Ram Memory : OK

Info: The following items of information are printed: model identification, serial number of the device, details of software installed, version and language code, reference of any options installed.

SERVICE

To enter the self-testing menu, switch on the device, press the MENU key and select and confirm the TOOLS, SELF-TEST, SERVICE(2) submenu using the arrow key (DOWN). When the access code is requested, press the following keys: FILTER – AMPLITUDES – SPEED – START and confirm.

the following tests are available in the service section:

9.1.2 Mark calibration

Confirm the submenu MARK CALIBRATION (1), position the mark at a distance from the sensor (visible near the exit from the device), and confirm “enter”

The microprocessor automatically reads the sensor output voltages, voltage with white paper and black mark, and then sets the digital trimmer that regulates the photodiode current to the optimal settings and then stores them.

The mark calibration voltages are shown on the display, as is the numerical position of the digital potentiometer.

9.1.3 Speed calibration

Testing and setting

Select and firm the SPEED CAL. (2) submenus, and the speed to calibrate

The following messages then appear on the display: Output PWM0 Output – Freq = xxxx Hz with the possibility of selecting from: test – change – exit.

Confirming the “test” command enables the paper feed and the print unit emits a 1 impulse per second signal. If the speed has to be calibrated, select “change” and increase or decrease the frequency to set the paper feed speed entered. When the speed has been set correctly, select and confirm with “exit”.

The permitted tolerance values for the various paper feed speeds are as follows:

- ✓ 50 mm/s ± -5%
- ✓ 25 mm/s ± -5%
- ✓ 5 mm/s ± -10%

9.1.4 Metres of paper printed

Displays the number of metres of paper printed.

9.1.5 Firmware upgrades

Enables upgrading of the instrument’s internal firmware.

The firmware upgrade menu can be accessed from the main menu, pressing the Shift + S keys together.

Note: Refer to the “Loader” programme manual for further information.

9.1.6 Print Screen

Enable print screen (for internal use only)

It is highly recommended to leave this function disabled.

9.2 Print head alignment

In case of print head adjustment remove mother board as per § 8.3, then follow instructions provided in table T4, repeat adjustment until the best result is obtained.

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10 Periodic maintenance

The **ar1200 view** electrocardiograph has been designed to assure a high degree of reliability during the life cycle of the product.

Any incorrect conditions of use or anomalous operation will be signalled by messages on paper and on the display.

10.1 Inspection frequency

To guarantee a long and safe duration, the instrument and its accessories must be periodically inspected and checked.

Table 9 indicates the type and frequency of controls required, based on normal use of the electrocardiograph (about 4000 ECG recordings per year).

Warning: Check immediately if there are events not referring to normal use.

General and safety tests

Type of operation	Frequency - months
- full discharging and charging of battery	2
- check and clean printer head	3
- visual inspection of the device, patient cable and accessories	6
- execution of self-test	6
- check and clean paper roller	12
- check paper speed	12
- check keys and keyboard	12
- check keyboard membrane	12
- clean paper compartment and mark presence sensor	12
- check patient cables and electrodes	12
- check whole amplification chain (sensitivity test)	12
- replace battery	12
- check calibrations	12
- check leakage currents	24

Table 9

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11 Cleaning and disinfection

11.1 Cleaning the device, electrodes and patient cable

- ✓ *Device:* use a cloth dampened with water or ethyl alcohol. Do not use other chemical products or household detergents.
- ✓ *Electrodes:* remove the electrodes from the patient cable and wash under running water. Do not scratch the electrodes and do not wash the leads box and the patient socket.
- ✓ *Patient cable:* do not immerse in water, use a cloth dampened with alcohol or an equivalent solvent.

Note: the device cannot be sterilized! The electrodes can be sterilized with ethylene oxide.

11.2 Clean thermal head

To clean the printer thermal head correctly use a cloth slightly dampened with alcohol or an equivalent solution with the device off.

Proceed as follows:

- ✓ open the paper feed;
- ✓ pass the cloth over the dots of the thermal head without pressing too hard.

Warning: the printer thermal head is extremely sensitive to electrostatic potentials. Do not touch it for any reason. If necessary, handle it after connecting to a ground via a suitable protective bracelet or belt.

11.3 Cleaning the paper feed roller

To clean the paper feed roller correctly, remove it and use a soft cloth lightly dampened with alcohol or an equivalent solvent, turning the roller to clean the whole surface.

11.4 Cleaning the mark sensor

To clean the mark sensor correctly use a cloth slightly dampened with alcohol or an equivalent solution with the device off.

Proceed as follows:

- ✓ remove the paper feed;
- ✓ pass the cloth over mark sensor without pressing.

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12 Spare parts list

The code numbers of the spare parts are listed in table 12.1.

The spare part code is also indicated on the label identifying the main subassemblies inside the device.

To order a spare part, use the corresponding code number.

List of spare parts for the ar2100 view device code 80600062

Spare part code	Description	Ref	Note
69700788	FUSE 0,5 AT 5X20 MM (10PCS)		Installed on mains plug
69701148	FUSE 5 A SMF SLO-BLO SMD (10PCS)		Installed on mother board
69701307	BLACK MARK PHOTOSENSOR BOARD AR 600/AR 1200		
69701352	BATTERY PACK (5+5) X 1,2V		
69701354	MOTOR ASSEMBLY + GERAS AR 1200 II SERIE		
69701358	PAPER SPINDLE + PAPER BOARD GUIDE AR 1200		
69701360	MAINS PLUG SOCKET AR 1200		
69701361	THERMAL PRINTER – WRITING SYSTEM AR 1200		
69701363	MAINS POWER LABEL 115V E 230V		
69701440	DISPLAY + GR. SUPPORTO AR 1200 VIEW		
69701441	DISPLAY GLASS FOR AR 1200 VIEW		
69701492	ELECTRONIC KEYBOARD BOARD AR 1200 VIEW EXT.		
69701502	MOTHER BOARD+IRDA AR1200VIEW EXT C/LINE		
69701502E	MOTHER BOARD+IRDA AR1200VIEW EXT C/LINE		
69701503	KEYBOARD+TRADE MARK LABEL AR1200VIEW EXT C/LINE		
69701511	BATTERY COVER (WHITE)		
69701515	PAPER GUIDE + RUBBER ROLL AR 1200 (WHITE)		
69701517	BOTTOM CASE AR1200VIEW (WHITE)		
69701578	UPPER CASE AR1200VIEW (WHITE)		

Table 12.1

* The replacement motherboard is supplied complete with basic software in English and S/N 00000000.

To reinstall the configuration before the replacement of the motherboard, the following data must be supplied:

- ✓ device code number (REF)
- ✓ serial number (SN)
- ✓ language
- ✓ options purchased

et medical devices will send the corresponding firmware (binary file to load through the Loader application), which will install the correct S/N and enable the options previously purchased.

Warning: Once the firmware has been reloaded with a specific S/N it cannot be further modified.

Note: The data requested can be printed out directly by the instrument, using the info function on the self-test menu.

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13 Interconnections with medical systems

The device has an RS232 infrared interface to communicate with a PC equipped with specific programmes.
This type of connection guarantees the insulation required for connection with medical systems.
The communication with a PC occurs through a proprietary protocol – a standard IRDA protocol cannot be used.
et medical devices has validated the following IR interface devices for installation on the COM port of a PC.

- ✓ Extended System mod. ESI 9680B JETEYE
- ✓ ACTiSYS ACT-IR220L

Note: Do not install the drivers on the cd rom supplied on the PC. If the drivers should have been inadvertently installed, uninstall them.

14 Technical characteristics

A.c. mains power supply	Device with Class I power supply 230 V ± 10% 50/60 Hz 115 V ± 10% 50/60 Hz
Maximum current absorbed	*160 mA at 115 V ~ ±10%* 80 mA at 230 V ~ ±10%
Mains protection	Fuse: T 0.5 A
Internal power source	12 V – 1800 mah NiMH
Internal power supply protection	Pico fuse SHF SLO-BLO T 5 A Littelfuse
Applied part	CF type
Defibrillation protection	Internal
Input dynamic	± 300 mV @ 0 Hz. ± 10 mV in the bandwidth
Input impedance	> 100 MΩ on each electrode
Common mode rejection	> 100 dB with electrode impedance balanced
Frequency response	0,5 ÷ 150 Hz (-3dB)
Time constant	3.3 s
Acquisition	11 bit 1000 samples/s/channel printing and filters 500 samples/s/channel in calculation and filters Resolution 5 µV/bit
Leads	12 STANDARD leads 12 CABRERA leads 12 Personalise leads 8 acquired, 4 derived (III, aVR, aVL, aVF)
Signal memory	10 seconds for each lead in auto mode
Recording sensitivity	5 – 10 – 20 mm/mV ± 5%, auto* *2,5 - 5 – 10 – 20 mm/mV ± 5%, dependent on number of channels printed
Writing system	Thermal printer, 8 dot/mm Usable print height 108 mm
Print channels	Auto mode 3, 6, 3+ R Manual mode 3 – 6
Paper feed rate	5 mm/s ± 10% 25 – 50 mm/s ± 5%
Video speed	12,5- 25 – 50 mm/s
Heat sensitive paper	roll: in 120 mm , gridded, length 20 m *Z-fold pack*: in 120x100 mm (width x length) sheets, gridded, length 30 m
Pacemaker recognition	Records impulse in compliance with IEC 60601-2-51/Ed. standards 1
Filters	Mains interference: Modified notch digital filter 50 – 60 Hz with response @ 32 Hz (-3dB)

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	linear phase – on/off filter. Anti-drift: 0.5Hz high pitch linear phase filter always on cannot be switched off.
Serial interface	Infrared
Keyboard	Membrane keyboard with 18 function keys ,10 alphanumeric keys and 1 power-on indicator Led
Display	320x240 dot backlit graphic LCD monochromatic (4,7 inch) effective display area 100x75 mm
Optional programmes	Parameter calculation (optional) ECG HES interpretation (optional) Arrhythmia programme (optional) HRV heart rate variability (optional)
Type of use	continuous
Operating modes	*Manual:* acquisition and printing in real time *Automatic* : simultaneous acquisition *ECG Autotimer* acquisition at user-defined intervals
Optional	*Paper Saving* signal acquisition in simultaneous mode with possibility of copying or storing on PC. *PC-ECG:* signal transmission in real time to Personal Computer with R.T.E. programme *Arrhythmia Monitor* signal monitoring with recognition of arrhythmic events *HRV analysis* analysis RR interval variability in a specific period.
Option	Memory ECG measurements ECG interpretation arrhythmia HRV PC archiving PC ECG
Battery capacity	*Internal battery: 100 min.* with printing in 3 channels mode
Recharging time	Internal battery: 18 hours
Housing protection category	IP 20

Environnemental conditions:	
- operation	Environment temperature: from +10°C to +40°C *Relative humidity:* from 25% to 95% (without condensation) *Atmospheric pressure:* from 700hPa to 1060 hPa
- transport and storage	Environment temperature: from −10°C to +40°C *Relative humidity:* from 10% to 95% (without condensation) *Atmospheric pressure:* from 500 to 1060 hPa
Dimensions	320 x 72 x 240 mm (length x height x depth)
Weight	2150 grams without paper
Conformity to standards	EN 60601-1: 1990 EN 60601-1/A1: 1992 EN 60601-1/A2: 1995 EN 60601-1/A13: 1995 General standards for safety of electromedical equipment EN 60601-1-2: 1993 *Standards on electromagnetic compatibility of electromedical equipment* EN 60601-2-25: 1995 EN 60601-2-25/A1: 1999 Particular safety standards for electrocardiographs IEC 60601-2-51/Ed.1: 2003-02 Particular standards on essential recording and analysis performance safety of single and multichannel electrocardiographs

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15 APPENDIX A

15.1 Procedures for manipulating and storing components (ESD)

All modern electronic components, particularly those based on CMOS technology, may be irreparably damaged by even modest electrostatic discharges.

Precautions must be taken against electrostatic discharges when handling and working on electronic components sensitive to electrostatic discharges. ELECTROSTATIC SENSITIVE DEVICE (ESD).

Staff involved in checking, warehousing, shipping and assembly operations must be earthed through a suitable conductive bracelet compliant with safety standards. If this precaution cannot be taken, the operator must wear suitable antistatic shoes or boots.

Work equipment must be earthed.

Tables, work surfaces and other surfaces on which components are handled must be covered in conductive material and earthed.

All tables and work surfaces must be covered with a layer of conductive material and earthed.

The person performing the repair must be earthed with a suitable protective bracelet compliant with safety regulations.The material must be contained in suitable antistatic bags or containers, and labelled according to MIL STD 129J. The containers must guarantee adequate protection against impact and handling during transport.

All E.S.D. components must be stored in their original boxes and kept in special metal containers. While stored in the warehouse, electronic components must be kept in their original packaging.

Any containers used must be exclusively in metal and/or conductive material. If handled directly, the personnel must adopt the precautions specified above.

During handling cards must be stored in suitable antistatic containers.

Each component sensitive to electrostatic discharges will be identified by the abbreviation ESD.

In the Warehouse area containers are labelled with a suitable symbol.

Follow all the instructions in this procedure when dealing with E.S.D. components.

Warning: The manufacturer is not responsible for any damage to the device caused by insufficient or inadequate treatment, handling or work methods.

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16 APPENDIX B

16.1 Figures and illustrated tables

T1 External view
T2a Internal view connections
T2b Internal view fixing
T3 Particular view
T4 Writing system calibration
T5 Thermal head test point

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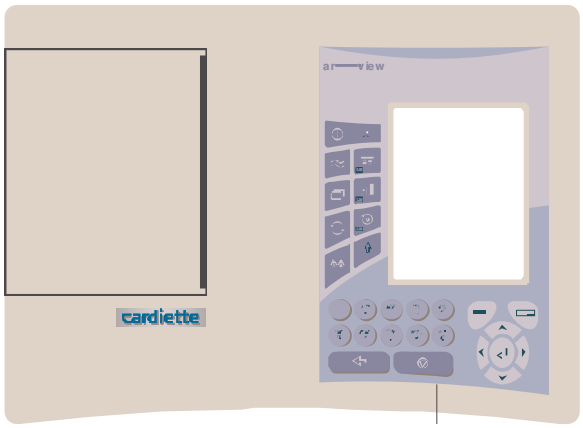
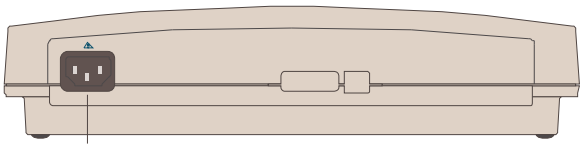
T1

VISTA DA SOPRA
TOP VIEW



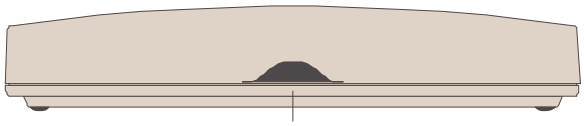
ar 1200 view TARGHETTA TASTIERA
KEY LABEL

VISTA POSTERIORE
REAR VIEW



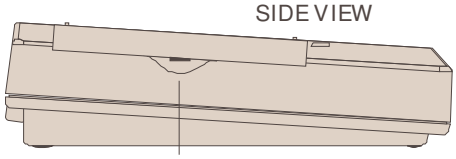
SPINA DI RETE
MAINS PLUG

VISTA ANTERIORE
FRONT VIEW



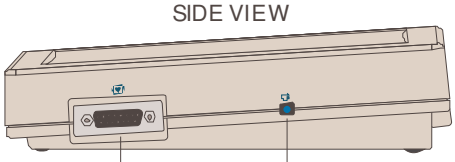
INTERFACCIA SERIALE I.R.
SERIAL INTERFACE I.R.

VISTA LATERALE
SIDE VIEW



SPORTELLO CARTA
PAPER COMPARTMENT

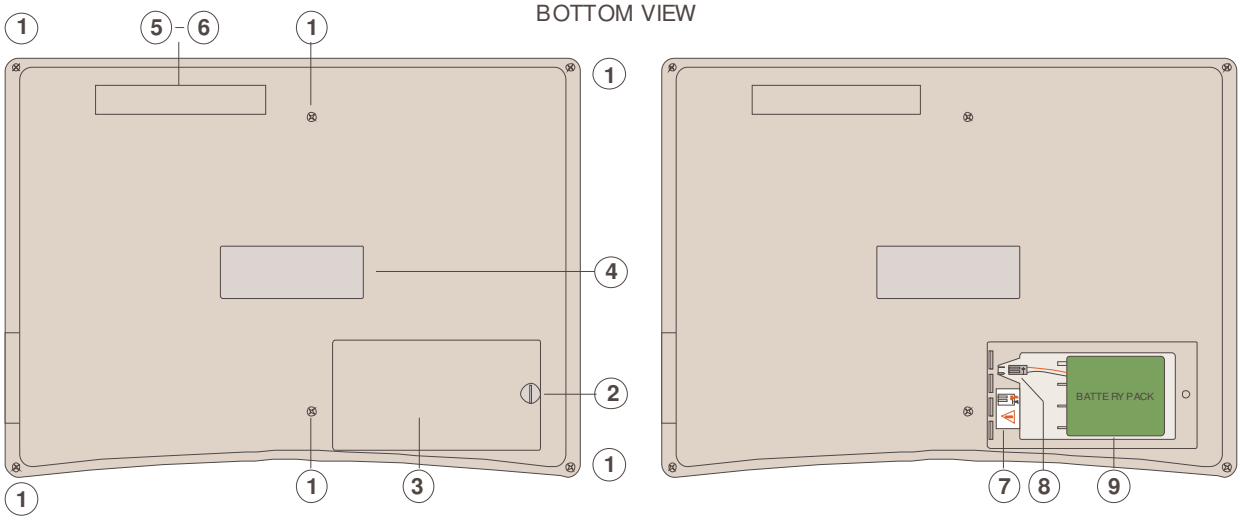
VISTA LATERALE
SIDE VIEW



INGRESSO PAZIENTE
PATIENT INPUT

TASTO RESET
RESET KEY

VISTA DA SOTTO
BOTTOM VIEW



1. VITI FISSAGGIO FONDO MOBILE
LOWER HOUSING FIXING SCREWS
2. VITE FISSAGGIO SPORTELLO VANO ACCUMULATORE
BATTERY COMPARTMENT LID FIXING SCREW
3. SPORTELLO VANO ACCUMULATORI
BATTERY COMPARTMENT LID
4. ETICHETTA IDENTIFICATIVA
IDENTIFICATION LABEL
5. 230 V~ 50-60 Hz 0.08 A
6. 115 V~ 50-60 Hz 0.16 A
7. INDICAZIONE CONNESSIONE BATTERIA
BATTERY CONNECTION LABEL
8. COLLEGAMENTO BATTERIA
BATTERY CONNECTION
9. BATTERIA
BATTERY PACK

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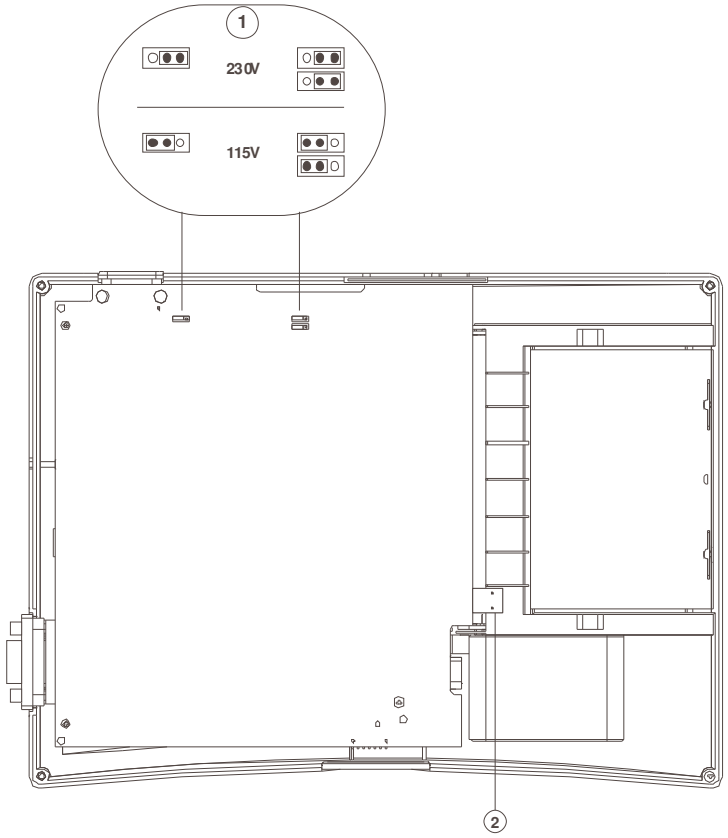
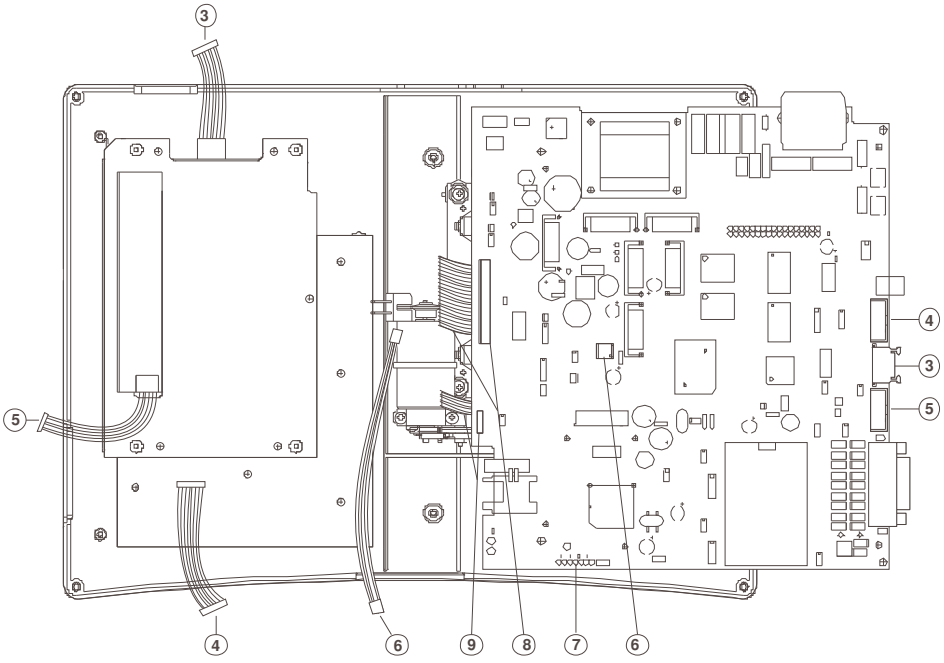
VISTA INTERNA - COLLEGAMENTI
INSIDE VIEW - CONNECTIONS

T2a



1. CAMBIO TENSIONE
MAINS POWER CHANGE
2. SCHEDA SENSORE TACCA
MARK SENSOR BOARD
3. FLAT / CONNETTORE DISPLAY
DISPLAY FLAT / CONNECTOR
4. FLAT / CONNETTORE TASTIERA
KEYBOARD FLAT / CONNECTOR
5. FLAT / CONNETTORE INVERTER
INVERTER FLAT / CONNECTOR
6. FLAT / CONNETTORE MOTORE
MOTOR FLAT / CONNECTOR
7. INTERFACCIA SERIALE I.R.
SERIAL INTERFACE I.R.
8. FLAT / CONNETTORE
TESTA TERMICA
THERMAL HEAD
FLAT / CONNECTOR
9. FLAT / CONNETTORE
SCHEDA SENSORE TACCA
MARK SENSOR BOARD
FLAT / CONNECTOR



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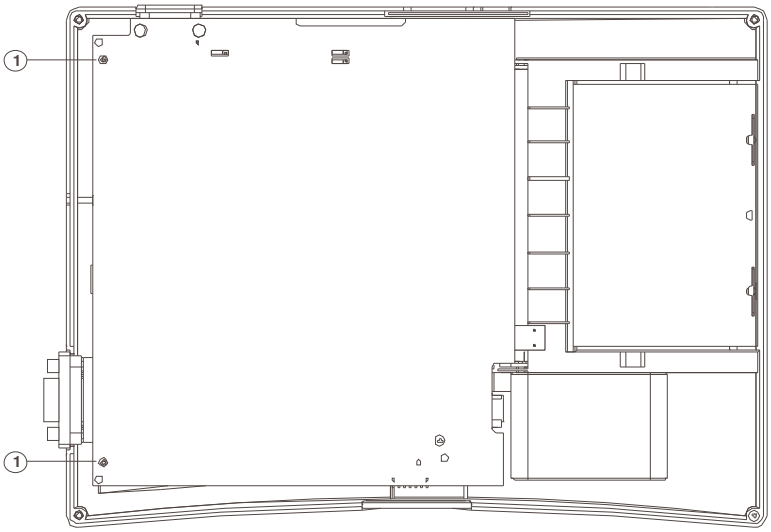
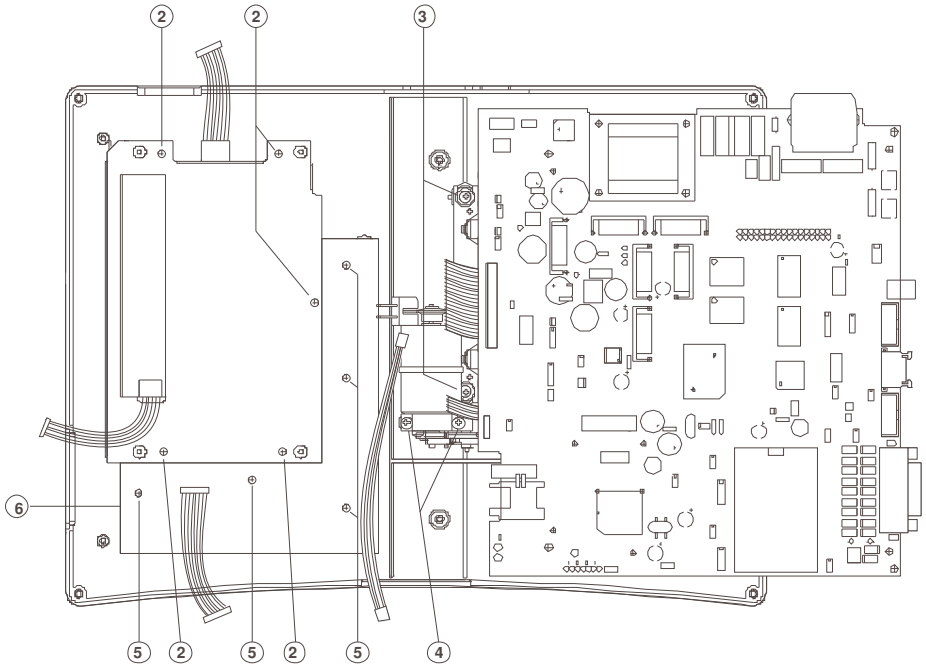
VISTA INTERNA - FISSAGGI
INSIDE VIEW - FIXING

T2b

1. VITI FISSAGGIO SCHEDA MADRE
   MOTHER BOARD FIXING SCREWS
2. VITI FISSAGGIO DISPLAY
   DISPLAY FIXIN G SCREWS
3. VITI FISSAGGIO SISTEMA SCRIVENTE
   WRITING SYSTEM FIXING SCREWS
4. VITI FISSAGGIO CHIMOGRAFO
   MOTOR SYSTEM FIXING SCREWS
5. VITI FISSAGGIO SCHEDA TASTIERA
   KEYBOARD FIXING SCREWS
6. SCHEDA TAST IERA
   KEYBOARD





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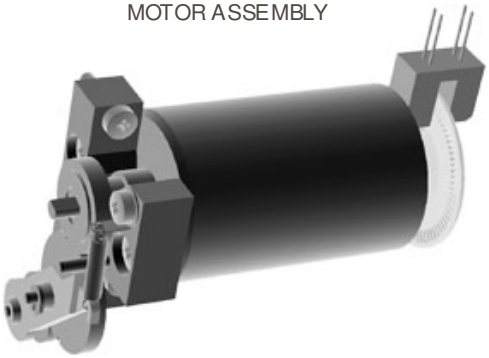
VISTA PARTICOLARI
DETAILS VIEW

T3

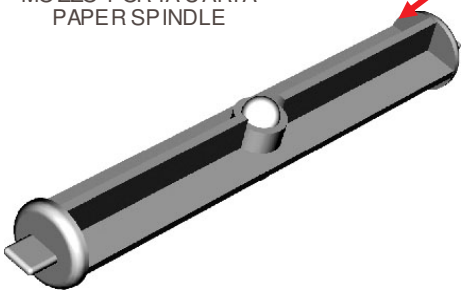
69701354

CHIMOGRAFO
MOTOR ASSEMBLY

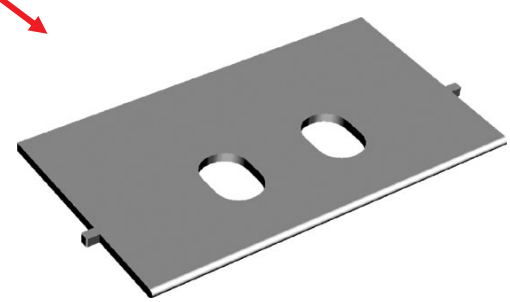


69701358

MOZZO PORTACARTA
PAPER SPINDLE

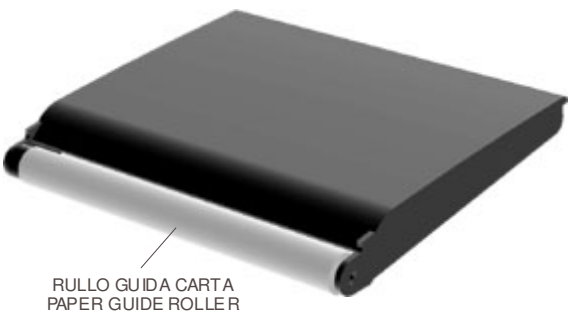


PIASTRA GUIDA CARTA
PAPER BOARD GUIDE



69701515

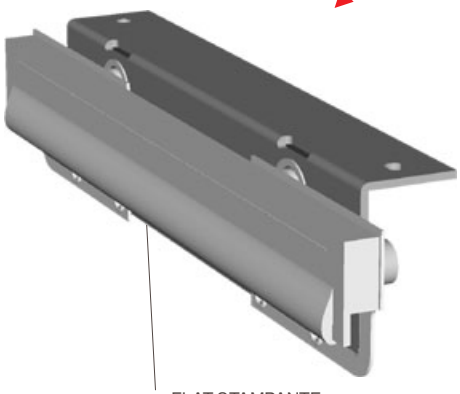
SPORTELLO CARTA
PAPER FEED



RULLO GUIDA CARTA
PAPER GUIDE ROLLER

69701361

SISTEMA SCRIVENTE
WRITING SYSTEM



FLAT STAMPANTE
FLAT THERMAL HEAD

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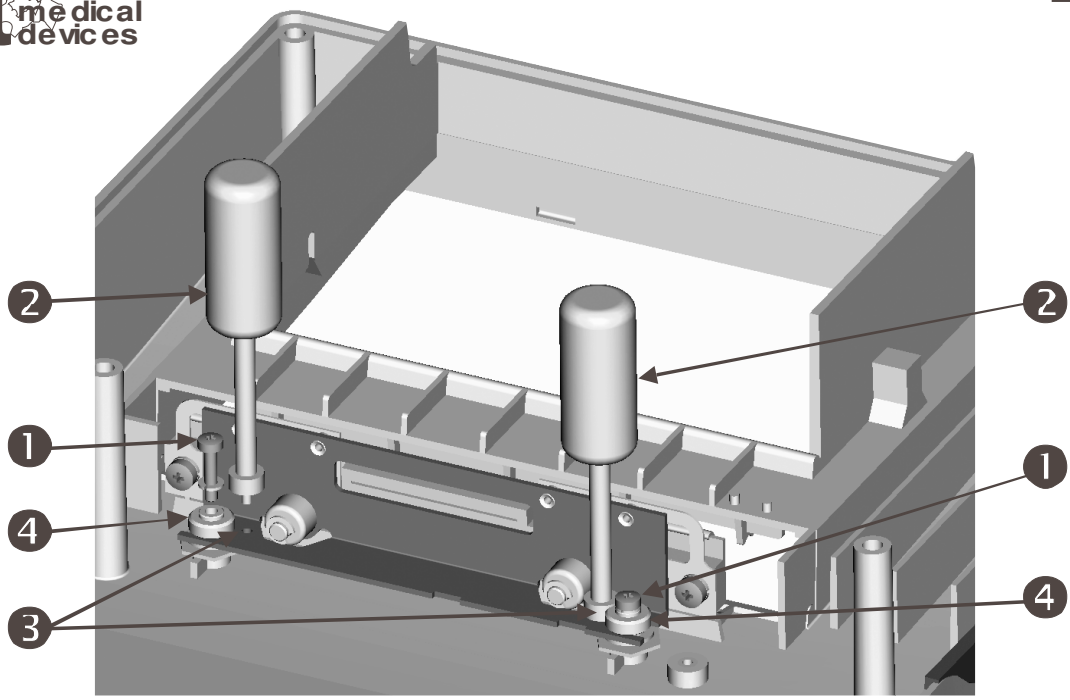
T4



ISTRUZIONI DI MONTAGGIO PER LA STAMPANTE

N.B. Prima di aprire l'apparecchio scollegare rete e accumulatore.

A) Fissare il gruppo stampante (fornito già tarato) con viti e rondelle ❶.

B) Eseguire le connessioni elettriche, chiudere l'apparecchio e verificare la qualità di stampa.

Nel solo caso di stampa non uniforme, procedere come segue:

- Togliere il solo fondo mobile .
- Inserire l'attrezzo ❷ nel foro ❸, regolare l'allineamento della testa termica ruotando in senso orario o antiorario l'apposito ingranaggio ❹ (max 1 giro dell'attrezzo).

WRITER MOUNTING INSTRUCTIONS

Note: Remove Mains and battery pack before servicing the equipment.

A) Fix writer assembly (already calibrated in factory) using proper screws and nuts ❶.

B) Reconnect all cables, close the equipment and check print quality.

If the printout is not uniform on all the paper width, do the following:

- Remove the back cover
- Insert tool ❷ in the location ❸, trim clockwise or counterclockwise in order to have the best print head lineament ❹ (max allowed 1 lap).

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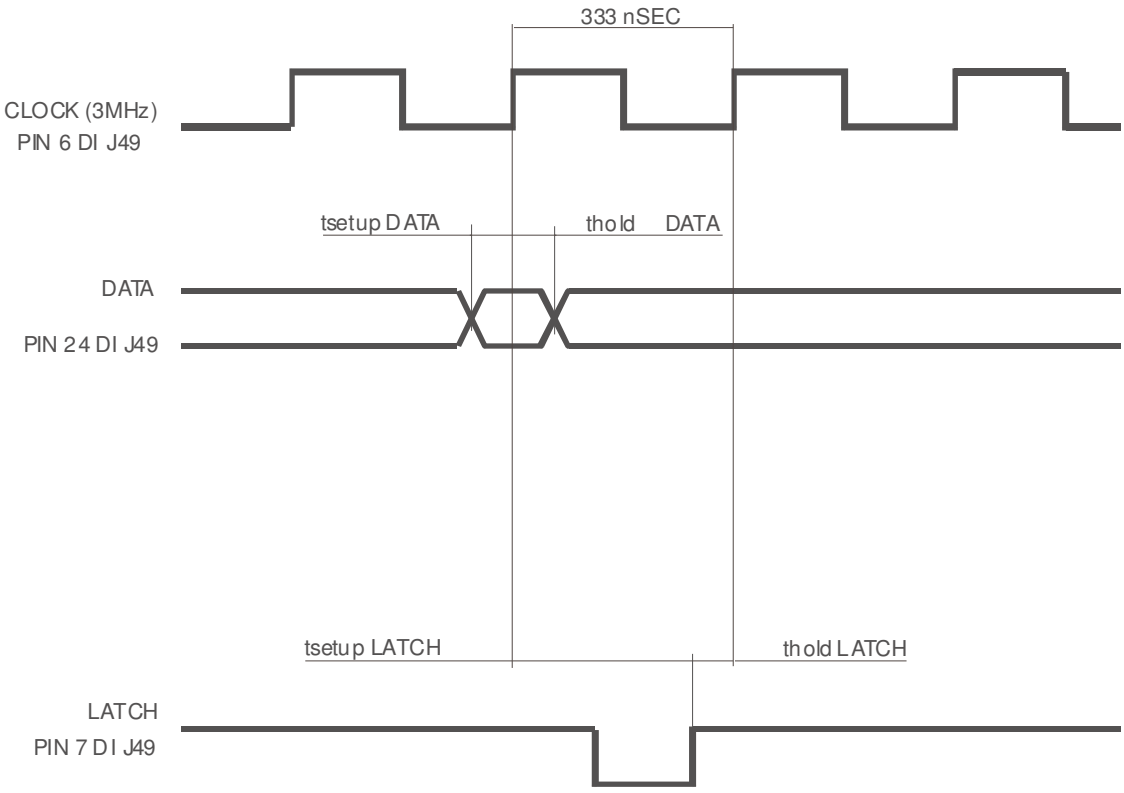
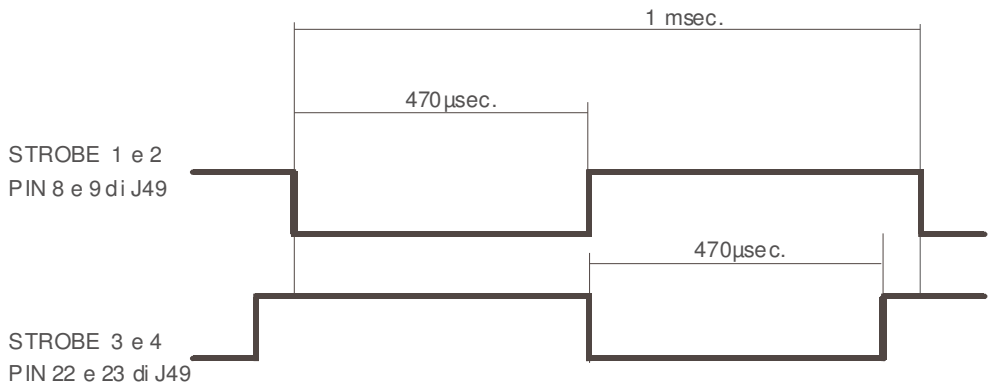
TEST POINT TESTA TERMICA
THERMAL HEAD TEST POINT
108 mm

T5





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17 Revision Sheet

Revision Sheet				
Service Manual	ECG AR 1200 VIEW			
Lang	English			
CODE	80509531 - 80509532			
REV	**OM**	**DESCRIPTION**	**DATE**	**SIGLA AP/DC**
01	---			
02	---			

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DIAGRAMS LIST
ECG ar 1200 view CARDIOLINE
115 V + 115 V 50/60 Hz

Code 80509531 - 80509532

Code diagram	Code subassembly	Description
30500086	----------	Block diagram
20002439	20002439	Sensor board
20002855	20002855	Keyboard
20002802	20002802	IR serial interface board
20002874	20002873	Mother board
27000241	27000241	Software

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